

## CLAIMS

What is claimed is:

- 1 1. A method, comprising:
  - 2 representing a charge pump output signal as a superposition of current
  - 3 steps that step in opposite directions at different times.
- 1 2. The method of claim 1 further comprising determining a filter output
- 2 voltage that results from said charge pump output signal by adding current step
- 3 responses to each of said current steps.
- 1 3. The method of claim 1 wherein a first of said current steps occurs when a
- 2 reference clock edge rises.
- 1 4. The method of claim 3 wherein said first current step is in a positive
- 2 direction.
- 1 5. The method of claim 1 wherein a second of said current steps occurs when
- 2 voltage controlled oscillator output clock edge rises.
- 1 6. The method of claim 5 wherein said second current step is in a negative
- 2 direction.
- 1 7. A method, comprising:
  - 2 a) calculating a filter output voltage by adding a pair of current step
  - 3 responses to a summation of prior pairs of current step responses;

4           b) calculating an instant of time when an integration of said filter  
5       output voltage will reach a reference voltage;  
6           c) triggering a voltage controlled oscillator output clock edge at said  
7       instant of time; and  
8           d) stepping a pair of current steps at a temporal offset with respect to  
9       one another, said temporal offset equal to a difference between a rising voltage  
10      controlled oscillator output clock edge instant of time and a rising reference clock  
11      edge instant of time.

1   8.     The method of claim 7 wherein said stepping a pair of current steps  
2     further comprises stepping a first current step at said rising reference clock edge  
3     instant of time.

1   9.     The method of claim 8 wherein said first current step is positive.

1   10.    The method of claim 8 wherein said stepping a pair of current steps  
2     further comprises stepping a second current step at said rising voltage controlled  
3     oscillator output clock edge instant of time.

1   11.    The method of claim 10 wherein said second current step is negative.

1   12.    The method of claim 7 further comprising setting said integration of said  
2     filter voltage to zero after said reference voltage is reached.

1   13.    The method of claim 7 wherein said calculating corresponds to a  
2     recalculation of when said filter voltage will reach said reference voltage, said

3 pair of current step responses produced by a lagging rising voltage controlled  
4 oscillator output clock edge.

1 14. A machine readable medium having stored thereon sequences of  
2 instructions which are executable by a digital processing system, and which,  
3 when executed by the digital processing system, cause the system to perform a  
4 method comprising, comprising:

5 representing a charge pump output signal as a superposition of current  
6 steps that step in opposite directions at different times.

1 15. The machine readable medium of claim 14 wherein said method further  
2 comprises determining a filter output voltage that results from said charge pump  
3 output signal by adding current step responses to each of said current steps.

1 16. The machine readable medium of claim 14 wherein a first of said current  
2 steps occurs when a reference clock edge rises.

1 17. The machine readable medium of claim 16 wherein said first current step  
2 is in a positive direction.

1 18. The machine readable medium of claim 14 wherein a second of said  
2 current steps occurs when voltage controlled oscillator output clock edge rises.

1 19. The machine readable medium of claim 18 wherein said second current  
2 step is in a negative direction.

1        20. A machine readable medium having stored thereon sequences of  
2        instructions which are executable by a digital processing system, and which,  
3        when executed by the digital processing system, cause the system to perform a  
4        method comprising:

5              a) calculating a filter output voltage by adding a pair of current step  
6        responses to a summation of prior pairs of current step responses;

7              b) calculating an instant of time when an integration of said filter  
8        output voltage will reach a reference voltage;

9              c) triggering a voltage controlled oscillator output clock edge at said  
10      instant of time; and

11              d) stepping a pair of current steps at a temporal offset with respect to  
12      one another, said temporal offset equal to a difference between a rising voltage  
13      controlled oscillator output clock edge instant of time and a rising reference clock  
14      edge instant of time.

1        21. The machine readable medium of claim 20 wherein said stepping a pair of  
2        current steps further comprises stepping a first current step at said rising  
3        reference clock edge instant of time.

1        22. The machine readable medium of claim 21 wherein said first current step  
2        is positive.

1    23.    The machine readable medium of claim 21 wherein said stepping a pair of  
2    current steps further comprises stepping a second current step at said rising  
3    voltage controlled oscillator output clock edge instant of time.

1    24.    The machine readable medium of claim 23 wherein said second current  
2    step is negative.

1    25.    The machine readable medium of claim 20 wherein said method further  
2    comprises setting said integration of said filter voltage to zero after said  
3    reference voltage is reached.

1    26.    The machine readable medium of claim 20 wherein said calculating  
2    corresponds to a recalculation of when said filter voltage will reach said  
3    reference voltage, said pair of current step responses produced by a lagging  
4    rising voltage controlled oscillator output clock edge.

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